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Cluster-Based Differential Evolution with Heterogeneous Influence for Numerical Optimization

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Abstract: This paper introduces a Cluster-based Differential Evolution Algorithm with Heterogeneous Influence for solving complex optimization problems. The idea behind this combination is to classify the Differential Evolution population into a number of clusters using k-means clustering method and to apply different mutation strategies for the clusters. The number of clusters is changed dynamically in each generation. The proposed algorithm uses three mutation strategies: DE/bestgroup/ 1/exp, DE/rand1/exp and DE/rand/1/bin. The DE/bestgroup/ 1/exp is an improved mutation strategy that randomly selects a portion of the population and then chooses the best individual in the group to guide the evolution. The k-means clustering algorithm is used periodically to fine-tune solutions that are generated from DE/best-group/1/exp by producing new clusters. This helps in balancing the exploration and exploitation capabilities by using different mutation strategies for these clusters to enhance diversity. The performance of the proposed approach is tested on 25 complex benchmark functions on single objective real-parameter numerical optimization. Results show that the proposed algorithm exhibits competitive performance when compared to other stat-of the-art algorithms algorithms.